REMARKS

The Final Office Action dated November 10, 2003, has been received and reviewed.

Claims 1-68 are currently pending and under consideration in the above-referenced application. Of these, claims 1-38, 40-47, 49-55, 57, 59-66, and 68 stand rejected, while the Office has indicated that claims 39, 48, 56, 58, and 67 recite allowable subject matter.

Reconsideration of the above-referenced application is respectfully requested.

Rejections Under 35 U.S.C. § 103(a)

Claims 1-38, 40-47, 49-55, 57, 59-66, and 68 stand rejected under 35 U.S.C. § 103(a).

M.P.E.P. § 706.02(j) sets forth the standard for a rejection under 35 U.S.C. § 103(a):

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Takeda in View of Landau

Claims 1-34, 49, 50, 53-55, and 57 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in U.S. Patent 5,748,198 to Takeda et al. (hereinafter "Takeda"), in view of teachings from U.S. Patent 6,529,207 to Landau et al. (hereinafter "Landau").

Takeda lacks any teaching or suggestion of culling back facing polygons of a three-dimensional digital image. The teachings of Takeda relate to methods for causing hardware that would not otherwise display back facing polygons to display selected back facing polygons. In so doing, the method that is taught in Takeda includes evaluating data that corresponds to at least the selected back facing polygons. If the data corresponding to these back facing polygons were culled, it could not be evaluated or displayed.

Takeda notes that it is often desirable to display "reflected" images that are located "behind" an observer. Col. 1, lines 53-64; *see also* FIG. 12. Mirrors reflect images that, although located "behind" an observer, would be back facing relative to the direction from which an observer views. At the time the application which resulted in Takeda was filed, however, most available hardware was only capable of depicting "front facing" polygons. Col. 2, lines 2-8. Thus, polygons which were "back facing" relative to the direction of an observer's viewpoint could not be depicted; *i.e.,* back facing polygons are automatically disregarded by the hardware. *Id.;* col. 2, lines 8-17. The result was that "mirror images" or any other images (*e.g.,* interior surface images) that were formed by back facing polygons could not be displayed (col. 2, lines 18-24) without doubling the number of polygons for a particular three-dimensional digital image and, consequently, slowing down the rate at which hardware displays and refreshes images thereof (col. 2, lines 42-45).

Although the hardware disregards data for back facing polygons, Takeda does not teach or suggest that such data is actually culled. If it were, the processes that are taught in Takeda would not work, as they require an evaluation of back facing polygons and manipulation of the data corresponding to selected back facing polygons for the purpose of displaying them.

Accordingly, the teachings of Takeda are drawn to methods for displaying back facing polygons, such as in the image of a rear view mirror or interior surfaces of hollow objects (*e.g.,* bubbles, balloons) into which a user's viewpoint extends, on hardware that could not otherwise display back facing polygons. Col. 2, lines 57-62. The methods of Takeda regarding this aspect of the teachings thereof include using an orientation (*i.e.,* front facing or back facing) "flag" which has been set for each polygon of a digital image, based on the orientation of that polygon relative to the direction from which an observer is viewing the digital image, in conjunction with one or both of a vertical inversion flag and a horizontal inversion flag. Col. 3, lines 19-38; col. 8, lines 46-64. If an inverted image is to be viewed, the coordinates of each polygon in the image are also inverted, the orientation flag is also changed, effectively changing back facing polygons to inverted front facing (*i.e.,* viewable) polygons and vice-versa. *Id.*

Based on the foregoing, it appears that the "sorting" discussed at col. 16, line 2, to col. 17, line 10, merely refers to sorting the polygons based on their relative Z-axis positions

(*i.e.,* distance from the "location" of an observer), independent from a determination of whether or not each polygon is front facing or back facing.

Landau teaches anti-aliasing techniques. In addition, Landau mentions use of a back face culling processes that include "computing the area . . . of each triangle as the cross product of the X, Y projections of two of the triangle sides." Col. 5, line 67, to col. 6, line 3. A sign of the cross product term indicates whether or not that triangle is front facing or back facing. Col. 6, lines 3-11.

It is respectfully submitted that there are a number of reasons that a *prima facie* case of obviousness has not been established against any of claims 1-34, 49, 50, 53-55, or 57, as is required to maintain the rejections of these claims under 35 U.S.C. § 103(a).

No Reasonable Expectation of Success

First, it is respectfully submitted that one of ordinary skill in the art would have had no reason to expect that the asserted combination of teachings from Takeda and Landau would have been successful.

In particular, if the back face culling processes of Landau were employed, there would be no back facing polygon data to evaluate and no back facing polygons to display in accordance with the teachings of Takeda.

Thus, one of ordinary skill in the art would have no reason to expect that incorporating the teachings of Landau into the method of Takeda would be successful or result in the methods recited in claims 1-16, the digital object-rendering systems of claims 17-34, or the digital image-rendering methods recited in claims 49, 50, 53-55, and 57.

Takeda Teaches Away from the Combination of References, As Asserted

Second, it is respectfully submitted that Takeda teaches away from combining the teachings thereof with those of Landau in the manner that has been asserted. Specifically, at page 18 of the outstanding Office Action, it is has been asserted that one of ordinary skill in the art would have been motivated "to combine the polygon data processing techniques used in Takeda . . . with the back-face culling system of Landau . . . in order to implement a system

utilizing the above-techniques to render *only front-facing polygons*, rather than those which are hidden from view . . ."

The entire purpose of the process taught in Takeda is, however, to display polygons that would otherwise be hidden from view. Thus, Takeda teaches away from combining the teachings thereof with teachings from a reference, such as Landau, that would prevent rendering or displaying back facing polygons.

Therefore, it is respectfully submitted that the Office has not established a *prima* facie case of obviousness against any of claims 1-34, 49, 50, 53-55, or 57 under 35 U.S.C. § 103(a).

There Would Have Been No Motivation to Combine the Teachings of Takeda and Landau

Third, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to combine the teachings of Takeda and Landau in the manner that has been asserted. In particular, it has been asserted that one of ordinary skill in the art would have been motivated, prior to the filing date of the above-referenced application, to combine teachings from Takeda and Landau to render obvious the methods and systems that are recited in claims 1-34, 49, 50, 53-55, and 57.

As a back face culling method of the type taught in Landau would not be useful with the process for displaying back facing polygons taught in Takeda, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to combine the teachings of Takeda and Landau in the manner that has been asserted.

Moreover, each of claims 1-34, 49, 50, 53-55, and 57 mentions sorting positional data of three vertices that are sequentially positioned around the periphery of an analyzed polygon, an affirmative act of arranging the data (American Heritage College Dictionary, Tenth Edition (1997)), then calculating a cross product term for the polygon, as well as determining an orientation of the polygon.

Takeda involves a process in which the orientation of each polygon has already been determined, presumably by conventional processes, and, therefore, lacks any teaching or suggestion that would be of any use or motivation to one of ordinary skill in the art with respect

to developing a process for determining whether or not the polygons of a digital image are front facing or back facing.

Landau, which mentions back face culling, merely teaches a well-known conventional process for determining whether or not polygons are front facing or back facing. Notably, that process includes calculation of a cross product term, but lacks any sorting of data of at least three vertices based on their relative positions prior to effecting the cross product term calculation.

Although it has been asserted at page 19 of the outstanding Office Action that all data that is "input into a calculation [is] sorted or arranged in some way," the act of "sorting" is defined as "[t]o arrange . . ." American Heritage College Dictionary, Tenth Edition (1997). As Takeda and Landau do not teach or suggest an affirmative arrangement of the data, other than the order originally assigned to the data, it is respectfully submitted that Takeda and Landau both lack any teaching or suggestion that the data may be sorted.

Further, it is respectfully submitted that, before the filing date of the above-referenced application, one of ordinary skill in the art would not have been motivated to sort data of at least three vertices of each polygon of a digital image prior to calculating the cross product term of that polygon and determining whether or not the polygon should be displayed because Takeda, Landau, and the knowledge that was generally available in the art at that time do not provide any suggestion or motivation that a cross-product term that has been calculated on the basis of sorted data would have been useful; the mere calculation of the cross-product term was, at that time, deemed sufficient for determining whether a polygon was front facing or back facing.

It is, therefore, respectfully submitted that one of ordinary skill in the art would have found no motivation or suggestion in Takeda, Landau, or the knowledge that was generally available in the art to combine the teachings of Takeda and Landau in the manner that has been asserted.

From the teachings of the references that the Office has relied upon in making its rejections, it appears that any such motivation to combine the teachings of these references could only have been improperly gleaned from the teachings of the above-referenced application.

Accordingly, it is respectfully submitted that a *prima facie* case of obviousness under 35 U.S.C. § 103(a) has not been established against any of claims 1-34, 49, 50, 53-55, or 57.

Takeda and Landau Do Not Teach or Suggest Each and Every Claim Element

Fourth, it is respectfully submitted that the asserted combination of teachings from Takeda and Landau does not teach or suggest each and every element of any of claims 1-34, 49, 50, 53-55, or 57.

Independent claims 1 and 9 recite methods for preparing a digital object to be rendered. The methods of independent claims 1 and 9 include sorting data representative of at least three vertices of at least one polygon of the digital object, generating an orientation decision variable based on relative positions of the at least three vertices, and calculating a cross product term of the at least one polygon following the act of sorting.

While Takeda and Landau mention that a determination may be made as to whether or not each polygon of a digital image is front facing or back facing, and Landau notes that such a determination may be based on a cross product term of the data corresponding to each of at least three vertices of each polygon, Takeda and Landau both lack any teaching or suggestion that the data of the at least three vertices of that polygon may be sorted prior to determining the cross product term or that a determination of the orientation (*i.e.*, an orientation decision variable) may be based on the sorted data. Therefore, Takeda and Landau, taken either together or separately, do not teach or suggest each and every element of independent claim 1 or independent claim 9.

Takeda and Landau do not teach or suggest each and every element of any of claims 2-8, among other reasons, because each of these claims depends either directly or indirectly from claim 1.

Takeda and Landau do not teach or suggest each and every element of any of claims 10-16, among other reasons, because each of these claims depends either directly or indirectly from claim 9.

In addition, with respect to claims 6 and 14, it is respectfully submitted that neither Takeda nor Landau teaches or suggests generating an orientation decision variable substantially concurrently with sorting the data of the at least three vertices.

Moreover, neither Takeda nor Landau teaches or suggests that an orientation decision variable may be generated after data of at least three vertices of a polygon has been sorted, as recited in claims 7 and 15.

Independent claims 17 and 26 recite systems for rendering images of digital objects. The systems of independent claims 17 and 26 include a first logic circuit that sorts data representative of at least three vertices of at least one polygon of the digital object, a second logic circuit that generates an orientation decision variable based on relative positions of the at least three vertices, and a third logic circuit that, following sorting of the at least three vertices, calculates a cross product term of the at least three vertices.

Again, neither Takeda nor Landau, taken either together or individually, teaches or suggests calculating a cross product term of data of at least three vertices of a polygon after the data has been sorted. Moreover, Takeda and Landau both lack any teaching or suggestion that an orientation decision variable may be generated based on relative positions of at least three sorted vertices. As such, it is respectfully submitted that Takeda and Landau, taken either together or separately, do not teach or suggest each and every element of either independent claim 17 or independent claim 26.

Takeda and Landau do not teach or suggest each and every element of any of claims 18-25, among other reasons, because each of these claims depends either directly or indirectly from claim 17.

Takeda and Landau do not teach or suggest each and every element of any of claims 27-34, among other reasons, because each of these claims depends either directly or indirectly from claim 26.

Additionally, Takeda and Landau both lack any teaching or suggestion that logic circuits which sort data of at least three vertices of a polygon and generate an orientation variable based on relative positions of the at least three vertices may operate substantially concurrently, as recited in claims 24 and 33.

Also, neither Takeda nor Landau includes any teaching or suggestion that a logic circuit that sorts data of at least three vertices of a polygon and a logic circuit that generates an

orientation variable based on relative positions of the at least three vertices may comprise the same logic circuit, as recited in claims 25 and 34.

Independent claim 49 recites a method for rendering an image of a digital object. The method of independent claim 49 includes sorting data representative of positions of at least three vertices of a polygon of the digital object. Once the data has been sorted, a cross product term for the at least three vertices is determined. Thereafter, a determination is made as to whether or not the polygon is front facing or back facing. This determination is made based at least in part on an actual orientation of the at least three vertices, a sign of the cross product term, and a sorted order of the at least three vertices. If the polygon is back facing, it is culled.

It is again respectfully submitted that neither Takeda nor Landau, taken either separately or together, teaches or suggests sorting data of at least three vertices of a polygon of a digital object *before* determining a cross product term or determining an orientation (front facing or back facing) of a polygon based at least in part on an actual orientation of at least three vertices thereof, a sign of the cross product term of the at least three vertices, *and* a sorted order of the at least three vertices. It is, therefore, respectfully submitted that Takeda and Landau do not teach or suggest each and every element of independent claim 49.

Takeda and Landau do not teach or suggest each and every element of any of claims 50, 53-55, or 57, among other reasons, because each of these claims depends either directly or indirectly from claim 49.

It is also respectfully submitted that neither Takeda nor Landau teaches or suggests determining an orientation of a decision variable based on a sorted order of data representative of positions of at least three vertices of a polygon of a digital object, as recited in claim 53.

Additionally, it is respectfully submitted that Takeda and Landau both lack any teaching or suggestion that an orientation variable may be determined substantially concurrently with the sorting of data representative of positions of at least three vertices of a polygon of a digital object, as recited in claim 54.

Further, with respect to claim 55, it is respectfully submitted that neither Takeda nor Landau includes any teaching or suggestion that an orientation decision variable may be

determined following the sorting of data representative of positions of at least three vertices of a polygon of a digital object.

As Takeda and Landau do not teach or suggest each and every element of any of claims 1-34, 49, 50, 53-55, or 57, it is respectfully submitted that a *prima facie* case of obviousness under 35 U.S.C. § 103(a) has not been established against any of these claims.

Takeda in View of Landau and Baltaretu

Claims 35-38, 40-47, 51, 52, 59-66, and 68 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over teachings from Takeda, in view of teachings from Landau and the teachings of U.S. Patent 6,437,780 to Baltaretu et al.(hereinafter "Baltaretu").

The teachings of Takeda and Landau have been summarized above.

Baltaretu also teaches a process for determining a cross product term for the vertices of a polygon. Col. 17, lines 20-39. Baltaretu does not, however, teach that sorting of the data corresponding to the vertices may occur before the cross product term is determined. Rather, at col. 17, lines 46-58, Baltaretu teaches that any sorting of vertex data occurs *after* the cross product term has been calculated, noting that the "vertex sorter . . . uses the deltas" that were determined in calculating the cross product term "to determine the order of the three vertices relative to one another." Col. 17, lines 49-51.

As noted in the outstanding Office Action, these acts are effected in order to facilitate a determination of whether or not tiles on a computer screen are covered by a convex polygon. Office Action, page 12; Baltaretu, col. 2, lines 54-64.

It is respectfully submitted that there are several reasons that the asserted combination of references does not support a *prima facie* case of obviousness under 35 U.S.C. § 103(a) against any of claims 35-38, 40-47, 51, 52, 59-66, or 68.

No Reasonable Expectation of Success

First, it is respectfully submitted that one of ordinary skill in the art would have had no reason to expect that the asserted combination of teachings from Takeda, Landau, and Baltaretu would have been successful.

In particular, if the back face culling processes of Landau were employed, there would be no back facing polygon data to evaluate and no back facing polygons to display in accordance with the teachings of Takeda. Baltaretu does not provide any teachings that would selectively restore selected back facing polygons or otherwise remedy this problem.

Thus, one of ordinary skill in the art would have no reason to expect that incorporating the teachings of Landau and Baltaretu into the method of Takeda would be successful or result in the processes to which claims 35-38, 40-47, 51, 52, 59-66, and 68 are drawn.

Takeda Teaches Away from the Combination of References, As Asserted

Second, it is respectfully submitted that Takeda teaches away from combining the teachings thereof with those of Landau in the manner that has been asserted and that Baltaretu does not provide any teachings that would persuade one of ordinary skill in the art to make such a combination of reference teachings. Specifically, at page 18 of the outstanding Office Action, it is has been asserted that one of ordinary skill in the art would have been motivated "to combine the polygon data processing techniques used in Takeda . . . with the back-face culling system of Landau . . . in order to implement a system utilizing the above-techniques to render *only front-facing polygons*, rather than those which are hidden from view . . ."

The entire purpose of the process taught in Takeda is, however, to display polygons that would otherwise be hidden from view. Thus, Takeda teaches away from combining the teachings thereof with teachings from a reference, such as Landau, that would prevent rendering or displaying back facing polygons.

Therefore, it is respectfully submitted that the Office has not established a *prima* facie case of obviousness against any of claims 35-38, 40-47, 51, 52, 59-66, or 68 under 35 U.S.C. § 103(a).

There Would Have Been No Motivation to Combine the Teachings of Takeda, Landau, and Baltaretu

Third, it is respectfully submitted that one of ordinary skill in the art would not have been motivated to combine the teachings of Takeda, Landau, and Baltaretu in the manner that has been asserted.

In particular, while Baltaretu teaches sorting data that corresponds to the vertices of a polygon in connection with the calculation of a cross product term, the teachings of Baltaretu appear to be limited to conducting such sorting only after the cross product term has been calculated. Baltaretu teaches that the cross product term of a polygon is determined by a "delta calculator," then sent to a "vertex sorter," which sorts the data based on its relative positioning from left to right. Col. 17, lines 20-59. Thus, Baltaretu does not remedy the deficiencies of Takeda and Landau with respect to calculating a cross product term or determining an orientation (front facing or back facing) of a polygon during or after sorting of the data that corresponds to the vertices of the polygon, as required by claims 35-38, 40-47, 51, 52, 59-66, and 68. Thus, it is respectfully submitted that none of Takeda, Landau, or Baltaretu, nor the knowledge generally available in the art before the filing date of the above-referenced application would have provided one of ordinary skill in the art with any motivation to combine the teachings of these references in the manner that has been asserted.

Further, as this particular teaching is not present in any of the cited references, but is found in the specification of the above-referenced application, it appears that any motivation to combine the teachings of Takeda, Landau, and Baltaretu in the manner that has been asserted could only have been improperly based upon the hindsight provided by the teachings of the above-referenced application.

Takeda, Landau, and Baltaretu Do Not Teach or Suggest Each and Every Claim Element

Fourth, it is respectfully submitted that Takeda, Landau, and Baltaretu, taken either together or individually, do not teach or suggest each and every element of any of claims 35-38, 40-47, 51, 52, 59-66, or 68.

Independent claim 35 recites a method for processing a digital image that includes a plurality of polygons, each of which includes at least three vertices. The method of independent claim 35 includes sorting data representative of the at least three vertices for each polygon. Thereafter, the positional differences between adjacent vertices of each polygon are determined. Next, a cross product term for each polygon is determined from the positional differences. The cross product term and a sorted order of the data are evaluated to determine an orientation of each polygon. Polygons that are oriented in a back facing direction are culled.

It is respectfully submitted that Takeda, Landau, and Baltaretu, taken either together or individually, include no teaching or suggestion of sorting data of at least three vertices of a polygon *before* calculating a cross product term or determining an orientation of that polygon. Thus, Takeda, Landau, and Baltaretu do not teach or suggest each and every element of independent claim 35.

Takeda, Landau, and Baltaretu do not teach or suggest each and every element of any of claims 36-38 or 40-47, among other reasons, because each of these claims depends either directly or indirectly from claim 35.

Further, with respect to claim 46, it is respectfully submitted that none of Takeda, Landau, and Baltaretu teaches or suggests generating an orientation decision variable substantially simultaneously with sorting data representative of at least three vertices of a polygon.

It is also respectfully submitted that none of Takeda, Landau, or Baltaretu teaches or suggest generating an orientation decision variable following the sorting of data representative of at least three vertices of a polygon, as recited in claim 47.

Takeda, Landau, and Baltaretu do not teach or suggest each and every element of claim 51 or claim 52, among other reasons, because none of these references teaches or suggests

sorting data of at least three vertices of a polygon of a digital object *before* determining a cross product term or determining an orientation (front facing or back facing) of a polygon based at least in part on an actual orientation of at least three vertices thereof, a sign of the cross product term of the at least three vertices, *and* a sorted order of the at least three vertices, all of which are required by independent claim 49, from which claims 51 and 52 both depend.

Independent claim 59 is directed to a method for rendering an image of a digital object that includes a plurality of polygons. The method of independent claim 59 includes sorting data representative of at least three vertices of each polygon of the image. Once the data has been sorted, an orientation of the at least three vertices is determined based on a sorted order of the data. Thereafter, a determination is made as to whether or not the orientation of the at least three vertices of each polygon has changed from an actual orientation of the at least three vertices of that polygon. If the orientation of a polygon has changed, it is culled.

None of Takeda, Landau, or Baltaretu, taken either together or separately, teaches or suggests sorting data representative of at least three vertices of a polygon *before* determinations are made about the orientation of the at least three vertices and about whether or not the orientation of the at least three vertices has changed, then culling the polygon if the orientation has changed. Therefore, it is respectfully submitted that none of Takeda, Landau, or Baltaretu teaches or suggests each and every element independent claim 59.

Takeda, Landau, and Baltaretu do not teach or suggest each and every element of any of claims 60-66 or 68, among other reasons, because each of these claims depends either directly or indirectly from claim 59.

It is additionally submitted that none of Takeda, Landau, or Baltaretu teaches or suggests calculating a cross product term for each polygon of an image based on sorted data representative of at least three vertices of that polygon.

In view of the foregoing, it is respectfully submitted that a *prima facie* case of obviousness under 35 U.S.C. § 103(a) has not been established against any of claims 35-38, 40-47, 51, 52, 59-66, or 68.

For these reasons, withdrawal of the 35 U.S.C. § 103(a) rejections of claims 1-38, 40-47, 49-55, 57, 59-66, and 68 is respectfully requested.

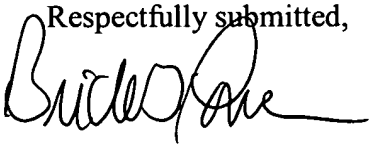
Allowable Subject Matter

The indication that claims 39, 48, 56, 58, and 67 recite allowable subject matter is gratefully acknowledged. Nonetheless, none of these claims has yet been amended to independent form, as the subject matter recited in each of the independent claims of the above-referenced application is also believed to be allowable.

CONCLUSION

It is respectfully submitted that each of claims 1-68 is allowable. An early notice of the allowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



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